ABT/S

Aluminum Billet Thermometer

User Guide

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IMPORTANT INFORMATION - PLEASE READ

Important Health and Safety Information

Equipment Operation
Use of this instrument in a manner not specified by Land Instruments International may be hazardous.

Electrical Power Supply
Before working on the electrical connections all of the electrical power lines to the equipment must be isolated. All the electrical cables and signal cables must be connected exactly as indicated in these operating instructions. If in doubt contact Land Instruments International.

Face and Eye Protection
Suitable face and eye protection must be worn when working on hot vessels and ducts! Special safety measures must be taken when working on a high-pressure duct.

Protective Clothing
Protective clothing must always be worn when working in the vicinity of hot vessels or ducts.

Storage
The instrument should be stored in its packaging, in a dry sheltered area.

Unpacking
Check all packages for external signs of damage. Check the contents against the packing note.

Return of Damaged Goods

IMPORTANT
If any item has been damaged in transit, this should be reported to the carrier and to the supplier immediately. Damage caused in transit is the responsibility of the carrier not the supplier.

DO NOT RETURN a damaged instrument to the sender as the carrier will not then consider a claim. Save the packing with the damaged article for inspection by the carrier.

Return of Goods for Repair
If you need to return goods for repair please contact our Customer Service Department. They will be able to advise you on the correct returns procedure.

Any item returned to Land Instruments International should be adequately packaged to prevent damage during transit.

You must include a written report of the problem together with your own name and contact information, address, telephone number, email address etc.

Return of Goods for Repair Form is available for download from our websites.

Lifting Instructions
Where items are too heavy to be lifted manually, use suitably rated lifting equipment. Refer to the Technical Specification for weights. All lifting should be done as stated in local regulations.

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Design and Manufacturing Standards

0034

The Quality Management System of Land Instruments International is approved to BS EN ISO 9001 for the design, manufacture and on-site servicing of combustion, environmental monitoring and non-contact temperature measuring instrumentation.

Approvals apply in the USA

This instrument complies with current European directives relating to Electromagnetic Compatibility 89/336/EEC and Low Voltage Directive 73/23/EEC.

Operation of radio transmitters, telephones or other electrical/electronic devices in close proximity to the equipment while the enclosure doors of the instrument or its peripherals are open, may cause interference and possible failure where the radiated emissions exceed the EMC directive.

The protection provided by both CE and IP classifications to this product may be invalidated if alterations or additions are made to the structural, electrical, mechanical or pneumatic parts of this system. Such changes may also invalidate the standard terms of warranty.

Dimensions
Unless otherwise stated, all measurements are given in millimetres and inches.

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Signs and Symbols Used on Equipment and Documentation

Caution, risk of electric shock.

Caution, attention to possibility of risk of damage to the product, process or surroundings. Refer to instruction manual.

Caution, hot surface.

This item or material can be recycled.

This item or material must be disposed of in accordance with the Waste Electrical and Electronic Equipment directive as applied by local regulations.

Protective Conductor Terminal.

Observe precautions for handling electrostatic discharge sensitive devices.

ABT/S

Contents

1 Introduction 1

1.1 About this Guide 1
1.2 About the ***ABT/S*** Thermometer System 1
1.2.1 System Features 2
1.3 Unpacking the ***ABT/S*** 2
1.4 Nomenclature 2
1.5 Specifications 3

2 Introduction to the ***ABT/S*** 4

2.1 System Overview 4
2.2 Billet measurement problems and solutions 4
2.2.1 The effect of alloy type and surface finish 5
2.2.2 Temperature gradients and speed of response 6
2.2.3 Effect of heater type 6
2.2.4 Effect of billet diameter 6
2.3 Choice of measurement location 8

3 Installing the ***ABT/S*** 9

3.1 Installing the Optic Head 9
3.2 Installing the Lightguide 10
3.3 Positioning the electronics unit 10
3.4 Electrical connections 14
3.4.1 Electrical connections to Landmark processors 14
3.5 Installing the processor 14
3.6 Connecting other Land thermometers to the system 16

4 Maintenance 18

4.1 Optic head 18
4.1.1 Replacement of the protection window 18

5 Operating the System 19

5.1 Configuring the processor 19
5.1.1 Landmark Graphic Snap Shot Configuration 19
5.1.2 Landmark Classic and Basic Configuration 19
5.2 Determining the optimum emessivity setting for a given billet 20

6 Accessories 21

6.1 ABT Purge Adapter 21

1 Introduction

1.1 About this Guide

This guide provides the information necessary to install and operate a Land Aluminum Billet Thermometer (***ABT/S***).

1.2 About the *ABT/S* Thermometer System

The Land ***ABT/S*** system is an application dedicated product designed for the measurement of aluminium billet temperatures. The system consists of a highly accurate, non contact radiation thermometer coupled to a Land Landmark Graphic AE signal processor.

Fig. 1 Aluminum Billet Thermometer AD990192

1.2.1 System Features

Unique Land emissivity enhancement technology provides high immunity to variation of alloy type and surface finish.

Extremely fast response allows checking of billet temperature characteristics during transfer from heater to press, without additional delay.

A fibre optics light guide, available in a range of lengths, allows the thermometer electronics to be located remotely from heat and induction fields.

1.3 Unpacking the *ABT/S*

The system comprises:

An ***ABT/S*** thermometer, consisting of optic head, light guide and thermometer electronics unit.

A Landmark Graphic AE (LMG AE) processor.

Documentation binder, containing:

ABT/S User Guide.

Landmark processor Installation Guide.

Landmark Graphic AE processor User Guide.

1.4 Nomenclature

The thermometer detail label is on the rear face of the thermometer.

Make a note of your thermometer Type and Serial Number in the space provided below. This information is required to configure a Landmark processor to work with your thermometer.

Instrument type:

ABT/S: ☐☐☐/☐☐☐☐☐ L ☐☐ S

e.g: ABT 300/600C L35 S

Serial Number: ☐☐☐☐☐☐/☐☐/☐☐

1.5 Specifications

Temperature range:	300 to 600°C/600 to 1100°F
Response time:	5ms (0 to 95%)
Typical accuracy in application:	±5°C/9°F
Stability (temperature): Stability (time):	0.2°/°ambient 2°C/4°F per year
Vibration:	3G Any axis 10 to 300 Hz
Humidity:	0 to 99% non condensing
Sealing:	To IP54 requirements
Ambient temperature: Optic head: Light guide: Electronics unit: Specified: Operating:	 165°C/330°F 200°C/392°F 0 to 50°C/32 to 122°F -10 to 60°C/14 to 140°F
EMC:	EN 50-082-2 (immunity), EN 50-081-1 (emission), IEC 1010 (safety)

2 Introduction to the ABT/S

The ***ABT/S*** is a fast, accurate, non contact radiation thermometry system, which is intended to replace thermocouples for the measurement of temperatures on the cylindrical surfaces of aluminium billets. Unlike other infrared devices that have been used in this application, the ***ABT/S*** has been developed specifically for measurements on these oxidised surfaces. It is therefore highly tolerant of changes in both alloy type and surface finish. Please note that the ***ABT/S*** is not recommended for measurements on 'fresh' aluminium surfaces such as the sawn end faces of the billet.

In the sections that follow, some of the issues involved in temperature measurements on aluminium billets are examined. Please consider this material carefully. It will help you to get the best performance from your ***ABT/S***

2.1 System Overview

The system has two main components, the ***ABT/S*** thermometer (Fig. 1) and a Landmark processor.

The ***ABT/S*** thermometer consists of an optic head, a fibre optics light guide, and an electronics unit. The optic head incorporates Land's unique non contact emissivity enhancement technology (patents applied for).

The recommended processor is the Snap Shot version of the Landmark Graphic, with special features to support the ***ABT/S*** thermometer. The processor retains its standard functions, such as averaging, peak-picking and graphical display, and can support up to four thermometers in total. Combinations of ***ABT/S*** and other Land thermometers are possible, subject to certain restrictions.

2.2 Billet measurement problems and solutions

There are several factors that affect the infrared 'signature' of aluminium billets. Alloy type, surface finish, and the use of gas and/or induction heating, can all be influential. The presence, in many cases, of a longitudinal temperature gradient, or 'taper', further complicates the measurement task.

2.2.1 The effect of alloy type and surface finish

The ***ABT/S*** uses Land's emissivity enhancement technology to raise the emissivity of the billet surface at the target location close to that of a black body source. This means that, in general, it is not necessary to adjust the system settings (ε = 0.95) to take account of either alloy type or billet condition. Exceptions to this are:

- 1000 series alloys exhibit very bright surfaces and typically require an emissivity setting of around 0.85.
- Billets produced by extrusion.
- Billets where the outer surface has been machined away after casting.

In all of the above cases, apply the procedure for determining the optimum setting for a given billet type, as described in Section 5.2.

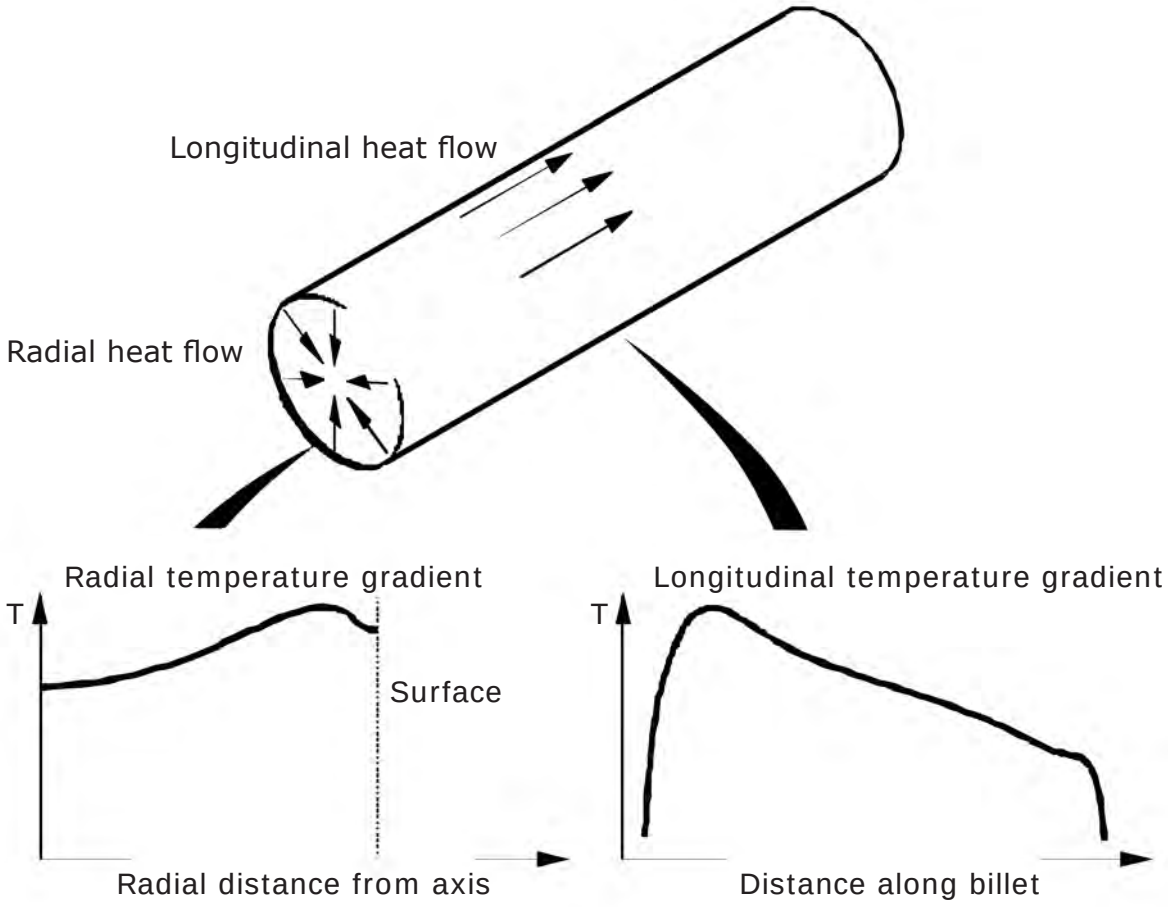


Fig. 2 Typical billet heat transfer characteristics AD990193

2.2.2 Temperature gradients and speed of response

It is important to recognise that the temperature distribution in a taper-heated billet is constantly changing. The billet will lose heat to its surroundings but this takes place fairly slowly.

Heat transfer within the billet is much more important in the short term, particularly when a taper has been applied. Temperature gradients within the billet will exist radially (surface to core), longitudinally, and rotationally (i.e. as a function of azimuth angle).

From the time heating stops the imposed temperature gradients will begin to decay (See Fig. 2). This internal heat transfer is relatively quick - longitudinal gradients (principally the applied taper) will typically halve every few minutes.

The speed of the measuring device is therefore very important. When using thermocouples for billet measurements, the taper may fall by as much as 5°C/9°F in the time the billet spends at the checking station.

The ***ABT/S*** has a much faster response than either thermocouples or the various multi-wavelength infrared thermometers typically used at the die exit. Typical accuracy of the ***ABT/S*** on 6000 series alloys is ±3°C/±6°F, which is comparable to the change in taper which could be expected to take place during a thermocouple measurement.

A single ***ABT/S*** unit can measure the taper of a passing billet, replacing a complete bank of thermocouples, without delaying the loading of the billet into the container.

The ***ABT/S*** processor temperature output is updated every 10ms. For typical billet lengths (~500mm/20in) and transfer speeds (~0.5m/s/1.5ft/s), this allows up to one hundred temperature data points to be recorded per billet.

2.2.3 Effect of heater type

The type of heater used has been found to have little effect upon the performance of the ***ABT/S***.

2.2.4 Effect of billet diameter

The ***ABT/S*** has been successfully tested on billet diameters from 175 to 225mm/7 to 9in. Larger diameters will not present problems but excessively small billets may require adjustment of the system settings, as per Section 5.2.

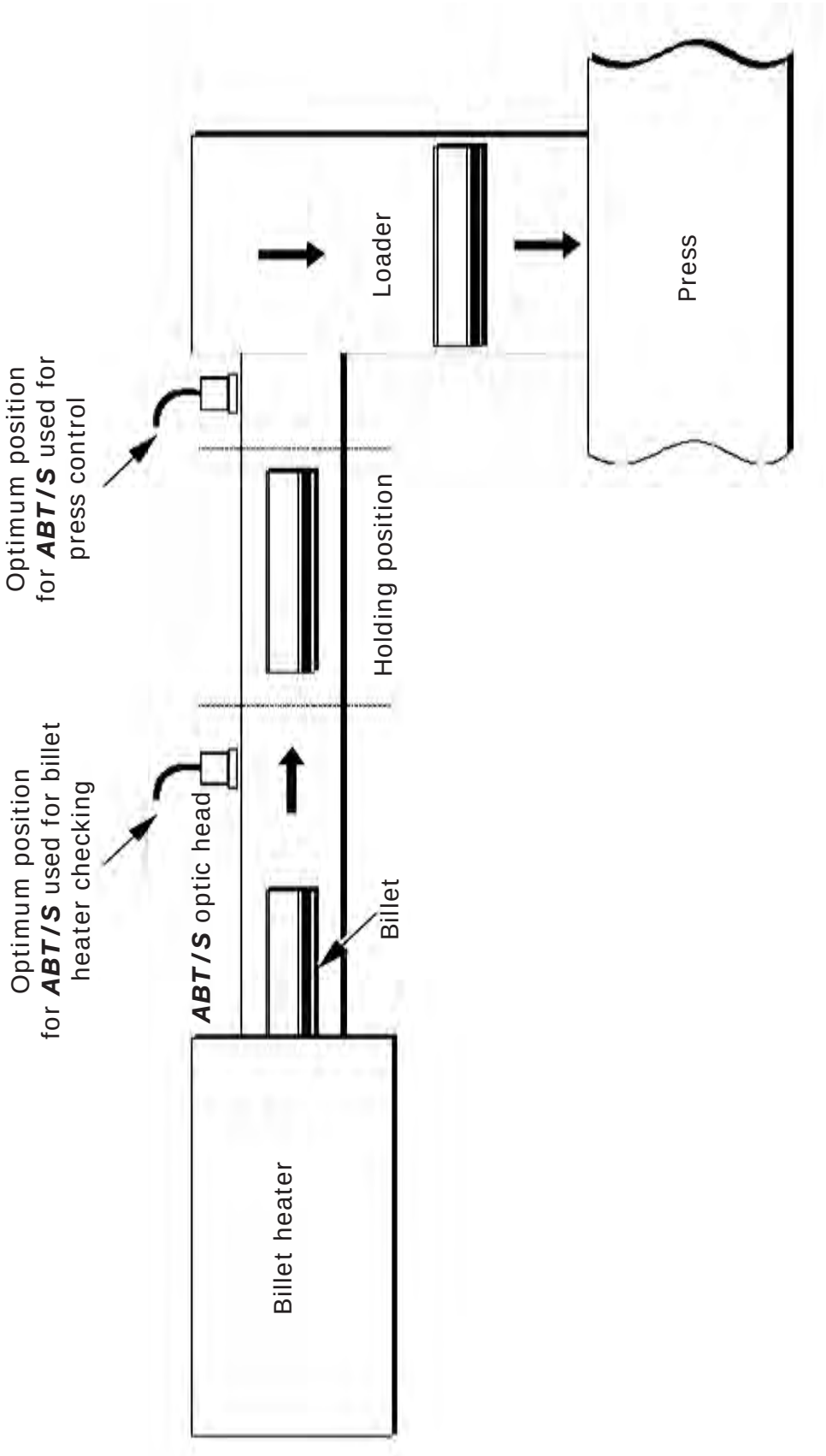


Fig. 3 Typical Aluminium Billet heater and press arrangement AD990194

2.3 Choice of measurement location

The ***ABT/S*** provides a superior alternative to banks of thermocouples in the measurement of billet tapers, either immediately prior to extrusion or on exit from the heater.

When measuring prior to extrusion, it is generally best to mount the optic head in the last suitable location before the loader. This allows time for the local surface and core temperatures to equalise but avoids additional loss of taper.

In certain cases, a considerable period of time (i.e. one in which significant cooling takes place) may elapse between a given billet exiting the heater and being loaded into the container. This typically arises when the billet emerges from the heater before the previous press cycle has been completed. In this situation, the billet is usually moved to a 'holding position' where it waits until the press is ready to accept it. If the ***ABT/S*** is being used as an aid to press control, the preferred location for the optic head is between the 'holding position' and the press. This gives a representative measure of the billet's temperature characteristics immediately before extrusion. Conversely, if billet heater performance is to be measured then the optic head should be located before the 'holding position'.

Most presses offer suitable locations for one or both modes of operation. A schematic diagram showing a typical press and heater layout is given in Fig. 3. The optimum position for the ***ABT/S*** in each case is marked.

One final consideration in choosing a location is the precision with which the billet is located. The optic head should be 15 to 20mm/0.6 to 0.8in from the billet surface, at the point of closest approach, so reproducible positioning of the billet is required (see Fig. 4).

3 Installing the ABT/S

NOTE

Read Section 2.0 of this User Guide before installing the thermometer.

3.1 Installing the optic head

Once a suitable location has been identified, the optic head must be positioned as shown in Fig. 4. The window surface should be 15 to 20mm/ 0.6 to 0.8in from, and parallel to, the billet surface at its point of closest approach.

The installation dimensions for the optic head are given in Figs. 5 and 6. The recommended mounting method is via the two M6 tapped holes on the rear of the unit. Alternatively, the optic head can be mounted via the four 6.5mm/0.25in holes in the front plate.

To prevent dirt collecting on the protection window, angle the unit downwards, as shown in Fig. 4.

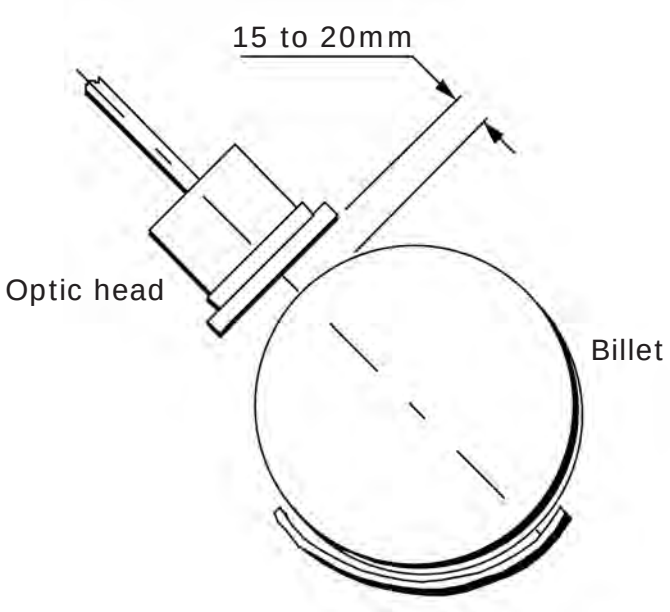


Fig. 4 Recommended orientation of Optic Head with respect to billet AD990195

3.2 Installing the lightguide

When installing the fibre optics light guide, observe the following precautions;

1) Ensure that the light guide is not be subjected to any tension or other undue force. It is not necessary to secure the light guide to surrounding structures unless, by leaving it hanging, it will vibrate violently, be a nuisance or a hazard.

2) Install the light guide as if it were a lightweight electrical cable and protect it if necessary. The minimum bend radius is 50mm/2in.

3.3 Positioning the electronics unit

When choosing a location for the electronics unit, observe the following precautions;

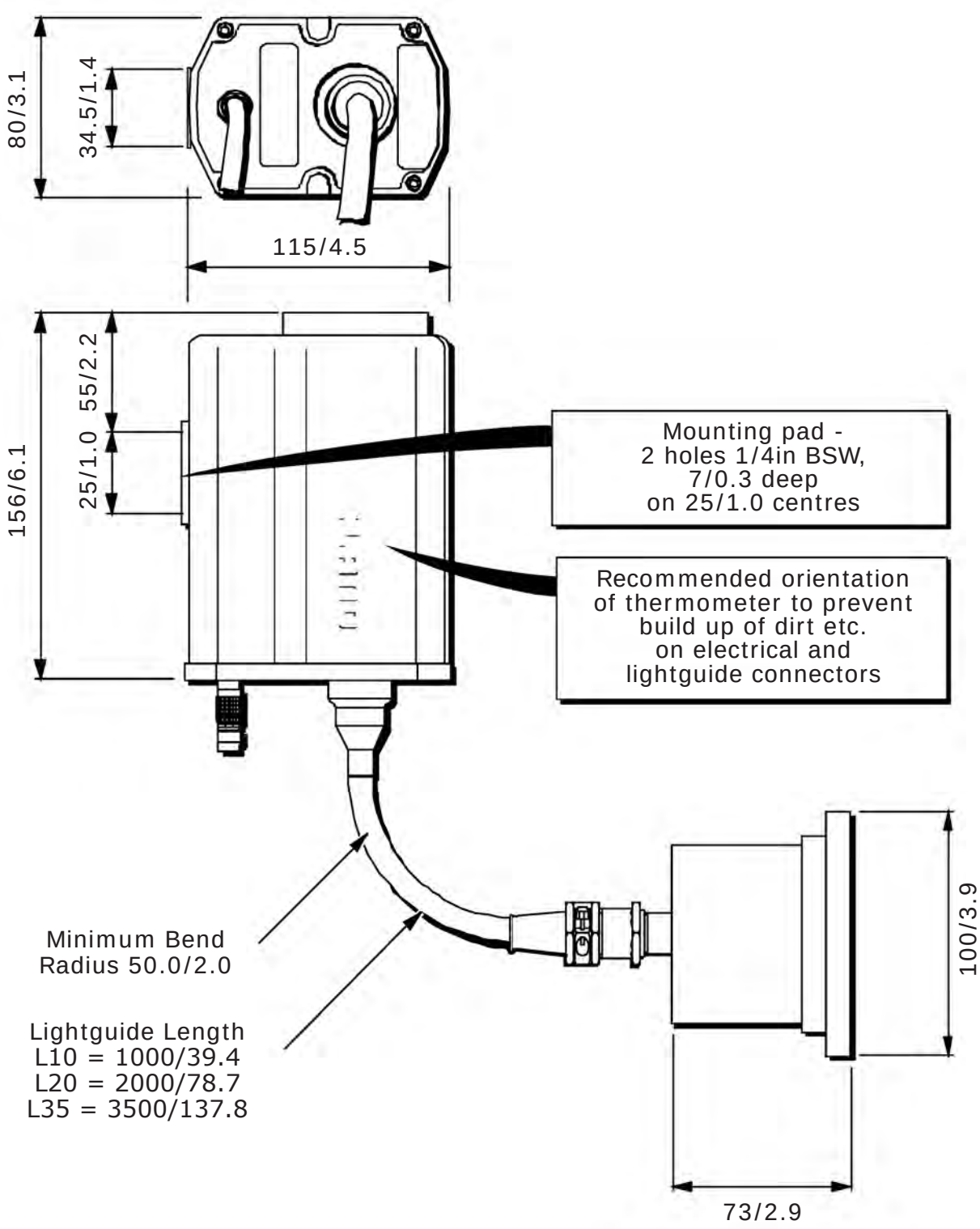
1) If the thermometer is to be installed in a location where the ambient temperature is outside the range specified for the thermometer, it must be mounted in a special cooling/heating jacket available from Land Infrared.

2) If the thermometer is to be used in conjunction with a protection jacket, refer to the Installation Guide provided with the jacket.

3) If the thermometer is to be installed in a location where the ambient temperature is within the range specified for the thermometer, it can be mounted using the two tapped holes on the mounting pad. Either hole can be used for direct tripod mounting.

4) Choose a location for the thermometer which is free from excess vibration, dirt and moisture.

5) It is recommended that, in order to minimise the build-up of dirt etc. on the electrical and light guide connectors, the thermometer is mounted such that these connectors are on the underside (as shown in Fig. 5).



All dimensions in mm/in.

Fig. 5 Aluminium Billet Thermometer installation dimensions AD990196

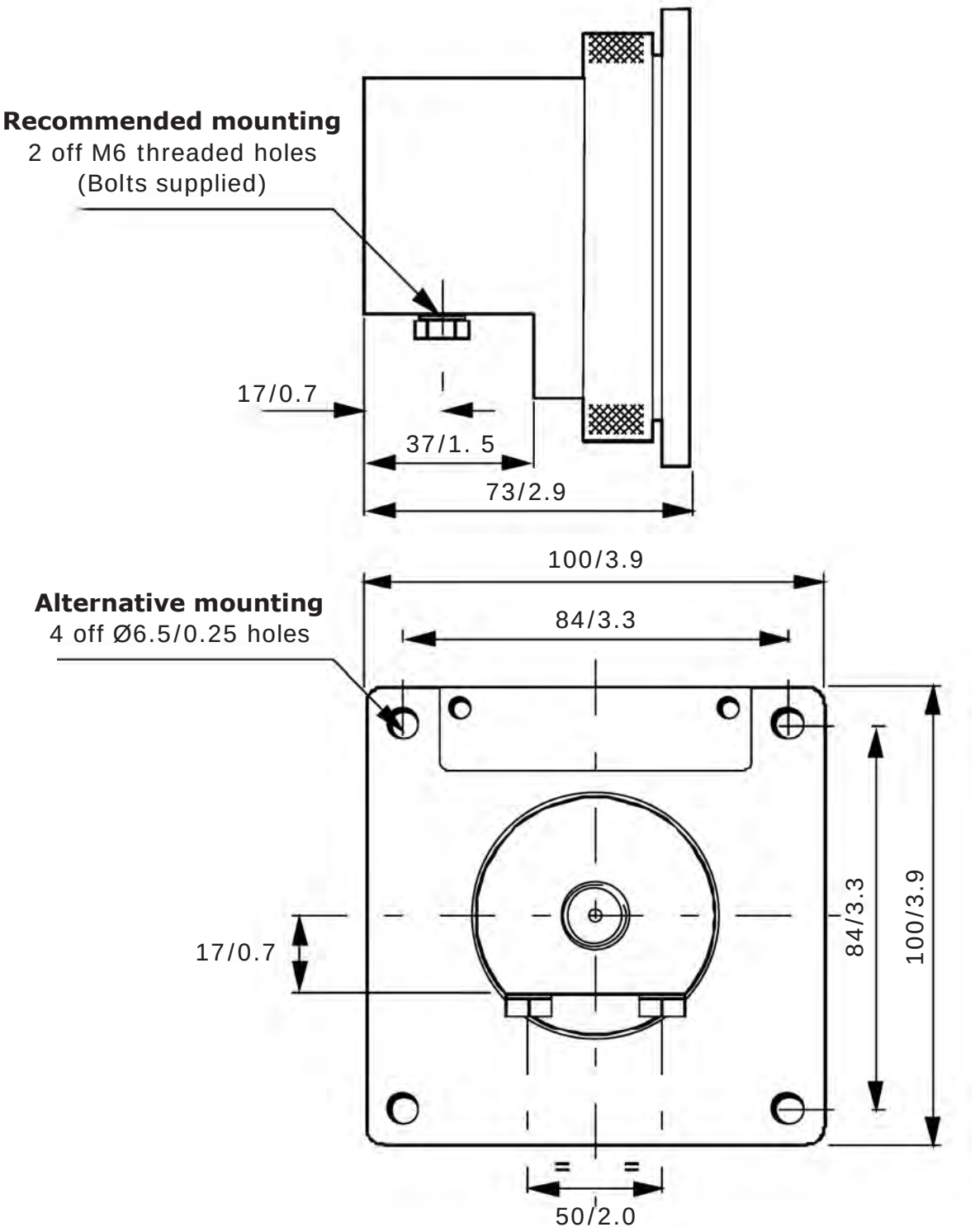


Fig. 6 Optic head installation dimensions AD00078

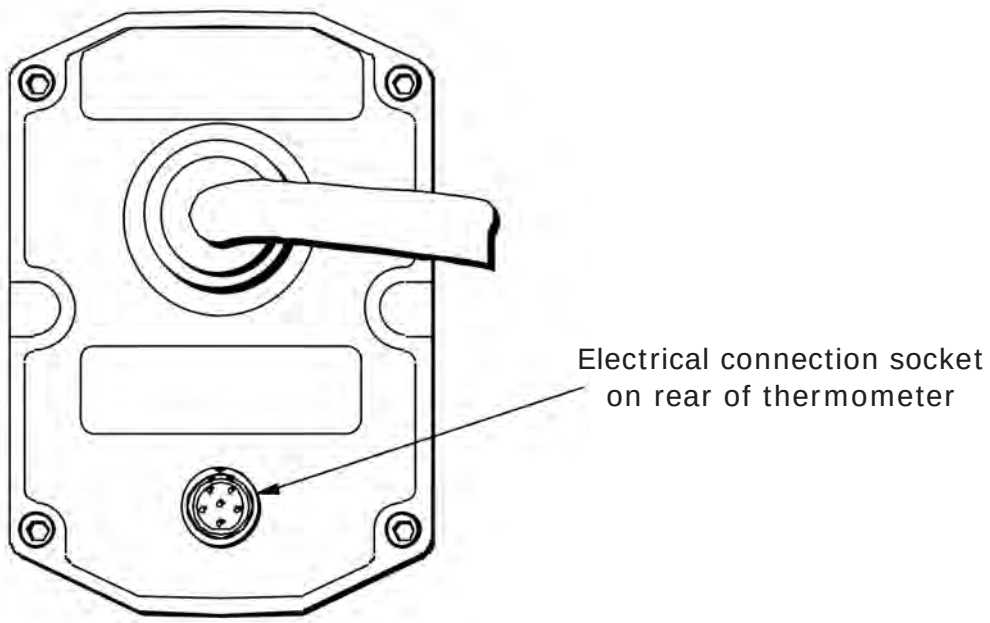


Fig. 7 Location of 6-way electrical connection socket AD990197

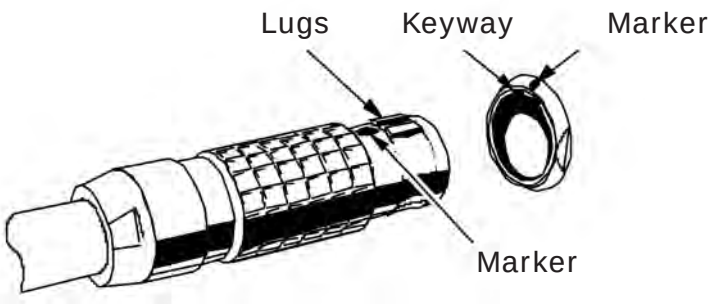


Fig. 8 Connection of pre-wired cable to the thermometer S4970229

Processor Pin Nº	Cable Colour	Function
1	Yellow	T+
2	Blue	T-
3	White	E+
4	Screen	Screen
5	Red	V+
6	Black	V-
7	Green	E-

Fig. 9 Cable connection schedule S4970230

3.4 Electrical connections

Refer to the Processor Installation Guide for the connection schedule.

If the LMG AE processor is used (as recommended), extra input cards can be added to allow the use of up to four thermometers in total (see section 3.6).

The electrical connections for the thermometer power supply, emissivity input and temperature output are made via the 6-way socket on the rear of the thermometer. See Fig. 7.

Electrical connection to the thermometer must be made via the pre-wired plug (LAND Part Nº 029.673).

To connect the cable;

1) Refer to Fig. 8. Align the red marker near the lugs of the pre-wired plug with the red marker above the keyway in the socket on the thermometer.
2) Push the plug into the socket.

To disconnect the cable;

1) Grip the ‘castellated’ section of the plug.
2) Pull the plug outwards to release the locking mechanism and disconnect the cable.

3.4.1 Electrical connection to Landmark processors

The thermometer derives its power supply, emissivity input and temperature output from the processor via the 6-way cable.

The cable connection schedule is given in Fig. 9.

3.5 Installing the processor

Refer to the relevant Landmark Processor Installation Guide.

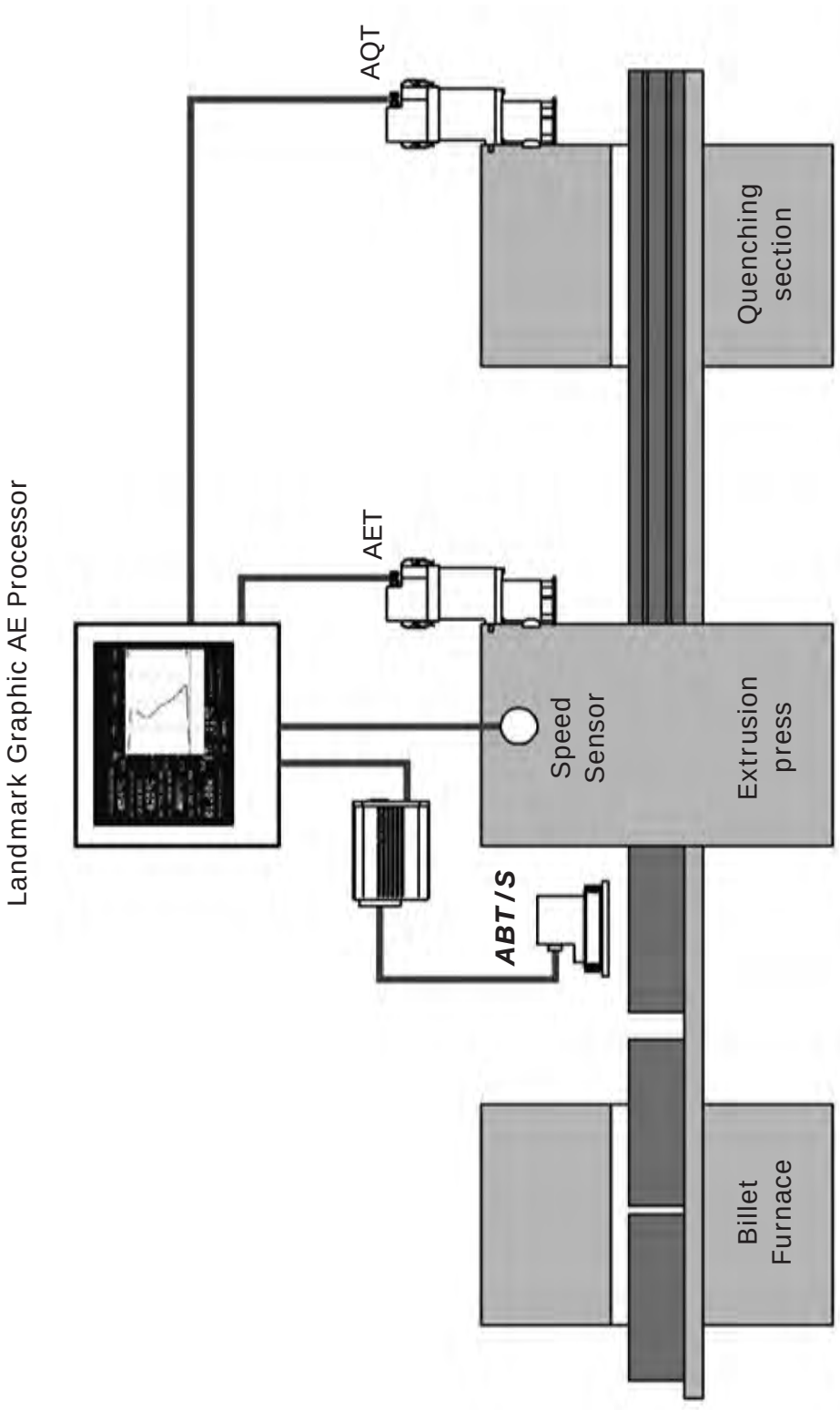


Fig. 10 Aluminium extrusion temperature measurement system (incorporating ***ABT/S***)

AD990198

3.6 Connecting other Land thermometers to the system

The LMG AE processor can support up to four thermometers. These can be any combination of Land ***ABT/S*** and System 4 thermometers.

This flexibility allows the ***ABT/S*** to form the basis of a complete extrusion thermometry package as shown in Fig. 10. A single display presents information from up to four infrared thermometers in a variety of formats.

Additional input cards can be fitted to an existing LMG AE processor. This procedure can be undertaken on-site and takes only a few minutes.

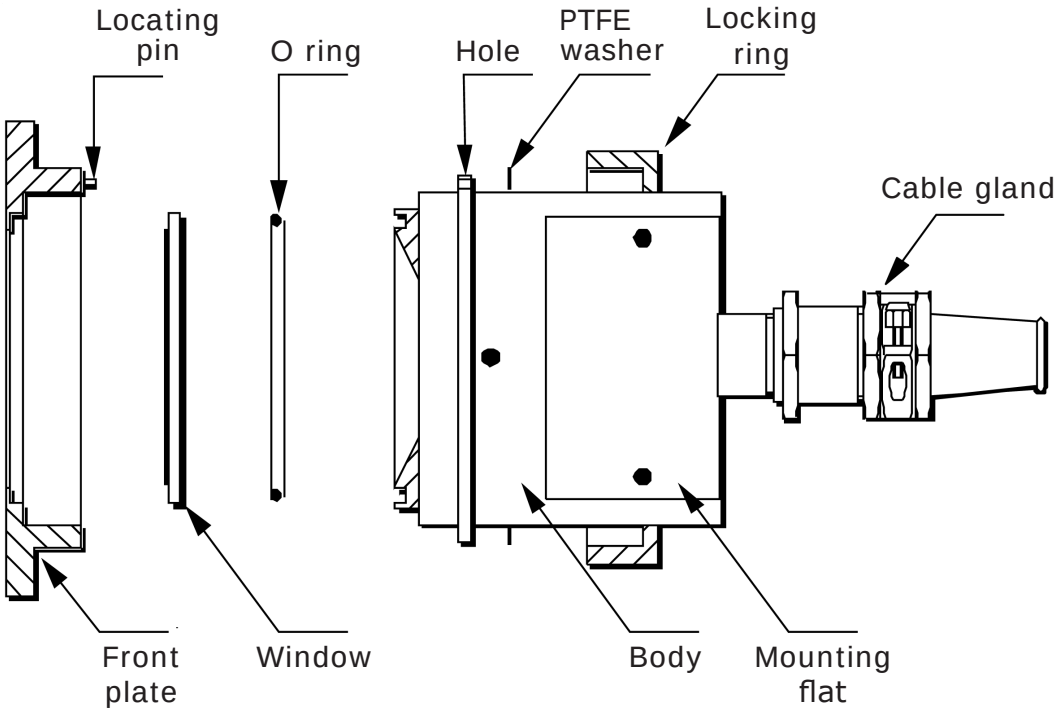


Fig. 11 Optic head assembly details AD990199

4 Maintenance

4.1 Optic head

After initial installation, make regular inspections of the optic head in order to establish a cleaning cycle.

If the optic head requires cleaning, wipe both the window and the front plate with a soft cloth. A little alcohol can be used to remove grease or oil if necessary.

4.1.1 Replacement of the protection window

If it is necessary to replace the protection window refer to Fig. 11.

1) Loosen the three grubscrews in the locking ring.
2) Slacken the locking ring.
3) Detach the front plate.
4) Remove the old window and position its replacement in the recess in the front plate.

   If necessary, use a small amount of silicone sealant to hold the window in place during reassembly.

   Note that the optic head can be installed with the mounting flat in any one of four orientations. Each orientation is determined by aligning the pin on the front plate with the appropriate hole on the body of the optic head.
5) Select the orientation which best suits the particular installation. Tighten the locking ring onto the front plate.

5 Operating the System

5.1 Configuring the processor

Landmark processors offer a wide variety of features, such as time-functions and, in the case of the Landmark Graphic AE, multi-channel and multi-language support. Irrespective of the type of processor used it must be configured for use with the ***ABT/S*** thermometer. Refer to the individual processor user guides for further details.

An emissivity value of 0.95 will usually give good results on 6000 series alloys. See also Sections 2.2.1 and 5.2.

5.1.1 Landmark Graphic Snap Shot Configuration

From the Thermometer Type list for the channel to which the Aluminium Billet Thermometer is connected, choose ***ABT/S***.

Settings for other Land aluminium extrusion products, including AET, should also be present. If these thermometer types are not in the list then the Landmark Graphic processor is not equipped to support the ***ABT/S***; contact Land for advice.

Set the required emissivity, as described in the Landmark Graphic AE User Guide.

It is advisable, particularly in multichannel systems, to set a suitable channel label, e.g. PRESS 1 or BILLET. Specific instructions are contained in the Landmark Graphic Snap Shot User Guide.

5.1.2 Landmark Classic and Basic Configuration

The required span (either 300°C or 500°F) and minimum temperature (either 300°C or 600°F) must be entered into the processor, by following the procedures described in the individual processor User Guides.

Next, set the required emissivity, as described in the processor User Guide.

5.2 Determining the optimum emissivity setting for a given billet

An emissivity setting of 0.95 (factory setting) will give best performance on 6000 series alloys. A setting of 0.85 will improve accuracy on 1000 series billets. To determine the optimum setting for a stationary billet of given type (alloy and surface finish) proceed as follows:

1) Position the optic head 15 to 20mm/0.6 to 0.8in from the billet, as shown in Fig. 4. Ensure that the surface area under the optic head is typical of that billet type; avoid heavily scratched or unusually black areas.

2) Take a reference thermocouple reading on the surface of the billet as close as possible to the optic head. On taper-heated billets it is generally better to take the reading at one of the two positions shown in Fig. 12 to minimise the differential between the two temperatures.

   Note that the temperature gradient along the billet can exceed 1°C per cm/4.5°F per inch, so accurate positioning is important.

3) Adjust the processor emissivity until the ***ABT/S*** and the thermocouple reading agree. For each degree Celsius that the ***ABT/S*** reads low with respect to the thermocouple, it will be necessary to reduce the emissivity setting by around 0.02.

   If an emissivity value greater than 1.00 is required, a poor thermocouple contact has been made.

4) Check the validity of the emissivity setting on a few more billets by comparing the reference thermocouple reading to the ***ABT/S*** display.

   In trials, optimum emissivity values between 0.88 and 0.98 have been obtained for billets of various commercial (6000 series) alloys. Slightly lower values (0.80 to 0.90) are expected on 1000 series alloys.

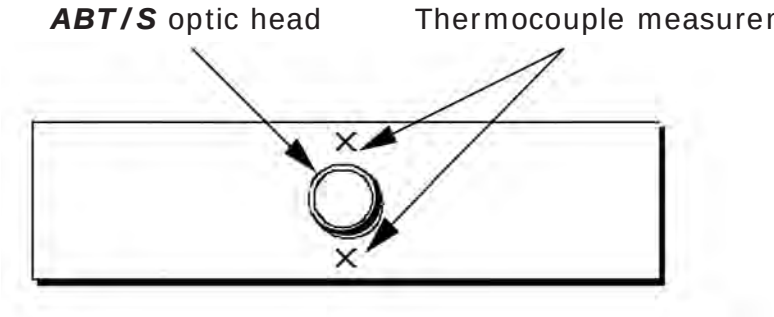


Fig. 12 Recommended position of reference thermocouple readings AD990200

6 Accessories

6.1 ABT Purge Adapter

The ABT Purge Adaptor provides an effective air purge facility for the ***ABT/S*** thermometer window. It is intended to extend the intervals between the cleaning of the thermometer window, in those installations where rapid contamination occurs. It does not however make the cleaning process unnecessary.

For more detailed information regarding ABT Purge Adapter installation and recommended air supply requirements, cross-refer to the ABT Purge Adapter Installation User Supplement (ABTP198.232), supplied with the accessory.

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PRODUCT WARRANTY

Thank you for purchasing your new product from Land Instruments International. This Land manufacturer's 'back-to-base' warranty covers product malfunctions arising from defects in design or manufacture. The warranty period commences on the instrument despatch date from the Land Instruments International Ltd. factory in Dronfield, UK.

36 MONTHS WARRANTY

Building upon the reputation for reliability and longevity that System 4 and UNO thermometers have earned, Land are delighted to be able to provide our customers with an industry-leading 36 month warranty for the following products:-

- System 4 thermometers, processors, accessories and mountings and special instruments based on System 4.
- UNO thermometers, accessories and mountings and special instruments based on UNO.
- Application-dedicated processors based on LANDMARK® Graphic.
- ABTS/S and ABTS/U.
- FTS.
- VDT/S and VDT/U.
- DTT.
- FLT5/A.

This 36 month warranty is provided as standard for all orders for the products listed above received from 1st May 2002.

We believe that our customers expect us to set the standard in terms of performance, quality, reliability and value for money. This 36 months warranty, as a part of an on-going program of continuous improvement, is just one way in which Land strive to maintain our position as the temperature measurement partner of choice.

12 MONTHS WARRANTY

All Land Instruments International products not provided with 36 months warranty (see list above), are provided with a 12 months warranty.

PRODUCT WARRANTY

EXCLUSIONS FROM WARRANTY

It should be noted that costs associated with calibration checks which may be requested during the warranty period are not covered within the warranty.

Land reserve the right to charge for service/calibration checks undertaken during the warranty period if the cause is deemed to fall outside the terms of the warranty.

This Land manufacturer's warranty does not cover product malfunction arising from:-

- incorrect electrical wiring.
- connection to electrical power sources outside the rating of the product.
- physical shock (being dropped, etc.) and impact damage.
- inappropriate routing, support, physical shock & strain protection, etc. of the lightguide (Fibroptic thermometers only).
- environmental conditions exceeding the IP / NEMA rating of the product.
- environmental conditions outside the Ambient Temperature, Humidity and Vibration rating of the product.
- environmental contamination (solvent vapours, deposition of airborne contamination, cooling liquids of non-neutral pH, etc.).
- overheating as a result of interruption of water/air flow through cooling jackets or of incorrect installation.
- inappropriate modification of product (drilling holes in thermometer bodies, etc.).
- inappropriate recalibration which results in product calibration being taken outside specification.
- improper resealing of thermometer following parameter adjustment (UNO, FLT5/A, etc.).
- attempted repair by a non-Land-authorised repair centre.

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